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Predicting market squid (*Doryteuthis opalescens*) landings from pre-recruit abundance
Fisheries Research (1.903)

A systematic surveillance program for infectious salmon anemia virus supports its absence in the Pacific Northwest of the United States
Journal of Fish Diseases (2.056)

Sea-ice cover timing in the Pacific Arctic: The present and projections to mid-century by selected CMIP5 models
Deep Sea Research Part II: Topical Studies in Oceanography (1.713)

Unlocking the potential of NEXRAD data through NOAA's Big Data Partnership
Bulletin of the American Meteorological Society (7.929)

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Ecosystem-based management affecting Brandt's Cormorant resources and populations in the Gulf of the Farallones, California
Biological Conservation (3.762)

Thermodynamic and dynamic causes of pluvial conditions during the last glacial maximum in Western North America
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Evaluation of multiple planetary boundary layer parameterization schemes in southeast U.S. cold season severe thunderstorm environments
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Flow cytometric monitoring of bacterioplankton phenotypic diversity predicts high population-specific feeding rates by invasive dreissenid mussels
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The effect of arc proximity on hydrothermal activity along spreading centers
Geochemistry, Geophysics, Geosystems (3.201)

Heating and moistening of the MJO during DYNAMO in ECMWF reforecasts
Journal of the Atmospheric Sciences (3.537)

The role of African dust in Atlantic climate during Heinrich events
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Spatially distinct, temporally stable microbial populations mediate biogeochemical cycling at and below the seafloor in hydrothermal vent fluids
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Agreement of CMIP5 simulated and observed ocean anthropogenic CO2 uptake
Geophysical Research Letters (4.456)

Heterogeneity of methane seep biomes in the northeast Pacific

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Volatility of Tornadogenesis: An ensemble of simulated nontornadic and tornadic supercells in VORTEX2 environments

AMS Monthly Weather Review (3.043)

The combined effects of acidification and hypoxia on pH and aragonite saturation in the coastal waters of the Californian Current Ecosystem and the northern Gulf of Mexico

Continental Shelf Research (2.064)

Anomalous blocking over Greenland preceded the 2013 extreme early melt of local sea ice

Annals of Glaciology (2.349)

Axisymmetric initialization of the atmosphere and ocean for idealized coupled hurricane simulations

Journal of Advances in Modeling Earth Systems (4.189)

Rewriting the tropical record books: The extraordinary intensification of Hurricane Patricia (2015)

Bulletin of the American Meteorological Society (11.808)

Cyanate distribution and uptake above and within the Eastern Tropical South Pacific oxygen deficient zone

Limnology and Oceanography (3.794)

A census of atmospheric variability from seconds to decades

Geophysical Research Letters (4.253)

Complementary use of glider data, altimetry, and model for exploring mesoscale eddies in the tropical Pacific Solomon Sea

Journal of Geophysical Research: Oceans (2.939)

NMFS Publications

Rethinking 'normal': The role of stochasticity in the phenology of a synchronously breeding seabird
Journal of Animal Ecology (4.474)

Simulated juvenile salmon growth and phenology respond to altered thermal regimes and stream network shape
Ecosphere (2.287)

Size-conditional smolting and the response of Carmel River steelhead to two decades of conservation efforts
PLoS One (3.057)

Age-based and reproductive biology of the Pacific Longnose Parrotfish *Hipposcarus longiceps* from Guam
PeerJ (2.2)

Comparative growth, age at maturity and sex change, and longevity of Hawaiian parrotfishes, with bomb radiocarbon validation
Canadian Journal of Fisheries and Aquatic Sciences (2.437)

Movement and survival of wild Chinook salmon smolts from Butte Creek during their outmigration to the ocean: Comparison of a dry versus wet year
Transactions of the American Fisheries Society (1.469)

Fishery collapse, recovery, and the cryptic decline of wild salmon on a major California river.
Canadian Journal of Fisheries and Aquatic Sciences (2.437)

An analytical approach to sparse telemetry data
PloS one (2.806)

Reproduction and morphology of Central American and Tres Marias spinner dolphins in the eastern tropical Pacific
Marine Mammal Science (1.665)

Process convolution approaches for modeling interacting trajectories
Environmetrics (1.532)

First satellite tracks of South Atlantic sea turtle 'lost years': Seasonal variation in trans-equatorial movement
Proceedings of the Royal Society B: Biological Sciences (4.823)

NESDIS Publications

Electron fluxes at geostationary orbit from GOES MAGED data
Space Weather (2.846)

Quality control of oceanographic in situ data from Argo floats using climatological convex hulls
MethodX (3.802)

Contrasting early Holocene temperature variations between monsoonal East Asia and westerly dominated Central Asia
Quaternary Science Reviews (4.571)

Global assessment of benthic nepheloid layers and linkage with upper ocean dynamics
Earth and Planetary Science Letters (4.724)

HIGHLIGHTED ARTICLES

*Predicting market squid (*Doryteuthis opalescens*) landings from pre-recruit abundance*
Fisheries Research (1.903)
S. Ralston, **E. Dorval**, L. Ryley, **K. M. Sakuma**, and **J. C. Field (NMFS/SWFSC)**
The fishery for market squid (*Doryteuthis opalescens*) in California is typical of many of the world's cephalopod fisheries, in that a very short life span and the

effect of environmental forcing on recruitment result in enormous interannual variability in catches and population size. We evaluate the utility of a pre-recruit index of squid abundance that is based on midwater trawl sampling in the 3-5 months preceding the onset of the fishery as a basis for predicting landings. Catches in the survey largely represent squid in the 30-50 mm dorsal mantle length size range, representing individuals 30-90 day old. Catch-per-unit-effort statistics are derived from simple two-factor Δ-Generalized Linear Models, with year and station as main effects and numbers per tow as the dependent variable. Regional models for northern and southern squid populations are developed. Pre-recruit indices, as well as indices of squid prey (krill) abundance are compared with landings data, as well as estimates of squid spawning stock biomass derived from an egg escapement model. Our results show that the abundance of pre-recruit market squid and krill sampled in the survey tracks both catches and overall population size, providing the potential to forecast landings. Our findings are consistent with a sparse but growing literature showing the potential utility of pre-recruit surveys to inform fisheries participants and managers.
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Available online:
http://www.sciencedirect.com/science/article/pii/S016578361730317X

A systematic surveillance program for infectious salmon anemia virus supports its absence in the Pacific Northwest of the United States
Journal of Fish Diseases (2.056)
L. L. Gustafson, L. H. Creekmore, K. R. Snekvik, J. A. Ferguson, J. V. Warg, M. Blair, T. R. Meyers, B. A. Stewart, K. I. Warheit, J. Kerwin, A. E. Goodwin, **L. D. Rhodes (NMFS/NWFSC)**, **J. E. Whaley (NMFS/IA)**, M. K. Purcell, C. Bentz, D. Shasa, J. Bader, and J. R. Winton

- In response to reported findings of infectious salmon anaemia virus (ISAV) in British Columbia (BC), Canada, in 2011, U.S. national, state and tribal fisheries managers and fish health specialists developed and implemented a collaborative ISAV surveillance plan for the Pacific Northwest region of the United States.

- Accordingly, over a 3-1/2-year period, 4,962 salmonids were sampled and successfully tested by real-time reverse-transcription PCR.
- Results of this surveillance effort provide sound evidence to support the absence of ISAV in represented populations of free-ranging and marine-farmed salmonids on the northwest coast of the United States.

In response to reported findings of infectious salmon anaemia virus (ISAV) in British Columbia (BC), Canada, in 2011, U.S. national, state and tribal fisheries managers and fish health specialists developed and implemented a collaborative ISAV surveillance plan for the Pacific Northwest region of the United States. Accordingly, over a 3-1/2-year period, 4,962 salmonids were sampled and successfully tested by real-time reverse-transcription PCR. The sample set included multiple tissues from free-ranging Pacific salmonids from coastal regions of Alaska and Washington and farmed Atlantic salmon (*Salmo salar* L.) from Washington, all representing fish exposed to marine environments. The survey design targeted physiologically compromised or moribund animals more vulnerable to infection as well as species considered susceptible to ISAV. Samples were handled with a documented chain of custody and testing protocols, and criteria for interpretation of test results were defined in advance. All 4,962 completed tests were negative for ISAV RNA. Results of this surveillance effort provide sound evidence to support the absence of ISAV in represented populations of free-ranging and marine-farmed salmonids on the northwest coast of the United States.

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Available online: http://onlinelibrary.wiley.com/doi/10.1111/jfd.12733/full

Sea-ice cover timing in the Pacific Arctic: The present and projections to mid-century by selected CMIP5 models

Deep Sea Research Part II: Topical Studies in Oceanography (1.713)

M. Wang, **Q. Yang**, **J. E. Overland**, and **P. J. Stabeno (OAR/PMEL)**

- The models from the Coupled Model Intercomparison Project (CMIP5) do well in simulating Arctic sea-ice break-up, freeze-up, and duration, compared to visual observations.
- Sea-ice duration in the Arctic is shrinking, with the greatest decreasing trend from 1990-2014, and is predicted to continue into the middle of the century.

- The projected annual sea-ice duration (2015-2044) is a loss of 20-36 sea-ice days in the Arctic, including earlier break-up and later freeze-up days, with the latter contributing greater to the shortening of sea-ice days.
- The East Siberian, Chukchi and Beaufort Seas will be greatest affected, with possible sea-ice day losses reaching 60 days, while the Bering Strait is estimated to lose 20 sea-ice days.

With the sea-ice cover in the Arctic fast declining, changes to the timing of sea-ice break-up and freeze-up is an urgent economic, social, and scientific concern. Based on daily sea-ice concentration data we assess three variables: the dates of sea-ice break-up and freeze-up, and the annual sea-ice duration in the Pacific Arctic. The simulation results from the coupled Atmosphere-Ocean General Circulation Models from phase 5 of the Coupled Model Intercomparison Project (CMIP5) are the source for this study. Compared with observations, CMIP5 models simulate all three variables well. The length of sea-ice duration is shrinking, with the strongest trend occurring for the period 1990–2014; this downward trend is projected to continue at least through mid-century by the CMIP5 models. Comparisons made at eight Chukchi Sea mooring sites and eight Distributed Biological Observatory (DBO) regions show consistent results. The 30-year averaged trend for annual sea-ice duration in the southern Chukchi Sea is projected to be -0.68 (-0.74) days/year to -1.20 (-1.17) days/year for 2015–2044 under RCP8.5 (RCP4.5) emissions scenarios. This is equivalent to a reduction of 20–36 days in the annual sea-ice duration. A similar negative trend is also found at all eight DBO regions. The reduction in annual sea-ice duration will include both earlier break-up dates and later freeze-up dates. However, models project that a later freeze-up contributes more than earlier break-up to the overall shortening of annual sea-ice duration. Around the Bering Strait area, future changes are the smallest, with less than 20 days change in duration during the next 30 years. In contrast, up to a 60-day reduction of the sea-ice duration in the East Siberian, Chukchi and Beaufort Seas is projected near the middle of the 21st century, when averaged over the period of 2030–2044.

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https://www.sciencedirect.com/science/article/pii/S0967064516302132

Unlocking the potential of NEXRAD data through NOAA's Big Data Partnership
Bulletin of the American Meteorological Society (7.929)

S. Ansari (NESDIS/NCEI), **S. Del Greco (NESDIS/NCEI)**, **E. Kearns (SO/CIO)**, **O. Brown (NESDIS/CICS)**, **S. Wilkins (NESDIS/CICS)**, M. Ramamurthy, J. Weber, R. May, J. Sundwall, J. Layton, A. Gold, A. Pasch, and V. Lakshmanan

- NOAA's Big Data Partnership (BDP) has facilitated unprecedented access to NEXRAD real-time and archive data, enabling cloud computing that is accessible, efficient and innovative.
- This collective effort among federal government, private industry, and academia has already realized a number of new and novel applications that employ NOAA's NEXRAD data, at no net cost to the US taxpayer.
- The volume of accessed NEXRAD data including this new AWS platform service has increased by 130%, while the amount of data delivered by NOAA/NCEI has decreased by 50%.

NOAA's Big Data Partnership (BDP) has facilitated unprecedented access to NEXRAD real-time and archive data, enabling cloud computing that is accessible, efficient and innovative. NOAA's Big Data Partnership (BDP) was established in April 2015 through cooperative research agreements between NOAA and selected commercial and academic partners. The BDP is investigating how the value inherent in NOAA's data may be leveraged to broaden their utilization through modern cloud infrastructures and advanced "Big Data" techniques. NOAA's NEXRAD weather radar data were identified as an ideal candidate for such collaborative efforts. NEXRAD Level-II data are valuable yet challenging to utilize in their entirety, and recent advances in weather radar science can be applied to both the archived and real-time data streams. NOAA's National Centers for Environmental Information (NCEI) transferred the complete NEXRAD Level-II historical archive, originating in 1991, through NC State University's Cooperative Institute for Environmental Information (CICS-NC) to interested BDP collaborators. Amazon Web Services (AWS) has received and made freely available the complete archived Level-II data through its AWS platform. AWS then partnered with Unidata/UCAR to establish a real-time NEXRAD feed, thereby providing on-demand dissemination of both archived and current data seamlessly through the same access mechanism by October 2015. To organize, verify, and utilize the NEXRAD data on its platform, AWS further partnered with The Climate Corporation. This collective effort among federal government, private industry, and academia has already realized a number of new and novel applications that employ NOAA's NEXRAD data, at no net cost to the US

taxpayer. The volume of accessed NEXRAD data including this new AWS platform service has increased by 130%, while the amount of data delivered by NOAA/NCEI has decreased by 50%.
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Available online: http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-16-0021.1

CROSS LINE OFFICE ARTICLES

Ecosystem-based management affecting Brandt's Cormorant resources and populations in the Gulf of the Farallones, California
Biological Conservation (3.762)
D. Ainley, **J. Santora (NMFS/SWFSC)**, P. Capitolo, **J. Field (NMFS/SWFSC)**, J. Beck, R. Carle, G. McChesney, M. Elliott, R. W. Bradley, K. Lindquist, P. Nelson, **J. Roletto (NOS/GFNMS)**, M. Hester, J. Jahncke, and P. Warzybok

- Brandt's cormorants are uniquely adapted to highly variable coastal upwelling ecosystems.
- A sequence of climate-linked and management related events helps to understand the dramatic shifts in abundance, productivity and distribution throughout central California over the past five to six decades.
- The population has significant potential to serve as an indicator of ecosystem state and productivity.

The Brandt's Cormorant of the California Current is a "boom-or-bust" species like its congeners in other eastern boundary, upwelling driven ecosystems, and like many of the prey upon which they depend. These birds produce many recruits when fish availability is high, leading to rapidly increasing populations, but few recruits, and may even exhibit die-offs, when the opposite is true. Unlike cormorants in the Peru and Benguela currents, however, Brandt's Cormorant population changes have yet to be correlated with those of its prey. Herein, using multi-decadal time series of cormorant colony size, diet, prey availability and mortality, in the context of changes in breeding site and fishery management, we provide insight into why central California colonies near San Francisco --- a major portion of this species' global population --- expanded from principally one offshore island in the 1960-70s to include a large mainland component by the 1990s. Involved were increases and decreases, respectively, of northern anchovy, a coastal species, and young-of-the year rockfish, more prevalent offshore. With

protection of breeding sites and a shift towards ecosystem-based fisheries management by the 1990s, variations of the central California Brandt's Cormorant population are now driven naturally by forage fish availability, and perhaps inter- and intraspecific competition for prey and space when population sizes are high. This species, owing to its "boom-or-bust" natural history and the relative ease of assessing breeding population size and diet, may be ideal for monitoring the state of the central California Current food web.
Publication date: November 16, 2017
Available online:
https://www.sciencedirect.com/science/article/pii/S0006320717310601

Thermodynamic and dynamic causes of pluvial conditions during the last glacial maximum in Western North America
Geophysical Research Letters (4.456)
C. Morrill (NESDIS/NCEI), D. Lowry, and **A. Hoell (OAR/ESRL)**

- This study performed a new analysis of simulations from nine models and consistently found that underappreciated processes, generally associated with steeper temperature gradients, contributed significantly to extreme wet conditions in western North America at the Last Glacial Maximum.
- The same atmospheric processes we identify as important at the Last Glacial Maximum are expected to cause regional drying in western North America under increased greenhouse gas concentrations.
- This study demonstrate that the atmospheric processes dominate across different climate conditions and strengthens the argument for future climate impacts in this region.

During the last glacial period, precipitation minus evaporation increased across the currently arid western United States. These pluvial conditions have been commonly explained for decades by a southward deflection of the jet stream by the Laurentide Ice Sheet. Here, analysis of state-of-the-art coupled climate models shows that effects of the Laurentide Ice Sheet on the mean circulation were more important than storm track changes in generating wet conditions. Namely, strong cooling by the ice sheet significantly reduced humidity over land, increasing moisture advection in the westerlies due to steepened humidity gradients.

Additionally, the removal of moisture from the atmosphere by mass divergence associated with the subtropical high was diminished at the Last Glacial Maximum (LGM) compared to present. These same dynamic and thermodynamic factors, working in the opposite direction, are projected to cause regional drying in western North America under increased greenhouse gas concentrations, indicating continuity from past to future in the mechanisms altering hydroclimate.
Acceptance date: November 27, 2017
Available online: N/A

Evaluation of multiple planetary boundary layer parameterization schemes in southeast U.S. cold season severe thunderstorm environments
AMS Weather and Forecasting (2.178)
A. Cohen (NWS/NCEP), S. Cavallo, **M. Coniglio (OAR/NSSL)**, **H. Brooks (OAR/NSSL)**, and **I. Jirak (NWS/NCEP)**

- These findings can contribute substantially to guiding the numerical modeling and operational meteorology community to the most appropriate planetary boundary layer parameterization scheme to be used in convection-allowing model guidance in the U.S. cold season severe thunderstorm environments, or SECOLD, regime.
- When considered in conjunction with analyses of rapidly evolving synoptic-scale and mesoscale mass fields governing forcing for ascent, a more complete understanding of the SECOLD regime can be achieved.
- The unique aspects of the SECOLD environment and many focused clues to assist with its depiction in numerical modeling identified throughout this work can give rise to additional investigation of this regime in future studies.

Southeast U.S. cold season severe weather events can be difficult to predict because of the marginality of the supporting thermodynamic instability in this regime. The sensitivity of this environment to prognoses of instability encourages additional research on ways in which mesoscale models represent turbulent processes within the lower atmosphere that directly influence thermodynamic profiles and forecasts of instability. This work summarizes characteristics of the southeast U.S. cold season severe weather environment and planetary boundary layer (PBL) parameterization schemes used in mesoscale modeling and proceeds

with a focused investigation of the performance of nine different representations of the PBL in this environment by comparing simulated thermodynamic and kinematic profiles to observationally influenced ones. It is demonstrated that simultaneous representation of both nonlocal and local mixing in the Asymmetric Convective Model, version 2 (ACM2), scheme has the lowest overall errors for the southeast U.S. cold season tornado regime. For storm-relative helicity, strictly nonlocal schemes provide the largest overall differences from observationally influenced datasets (underforecast). Meanwhile, strictly local schemes yield the most extreme differences from these observationally influenced datasets (underforecast) in a mean sense for the low-level lapse rate and depth of the PBL, on average. A hybrid local–nonlocal scheme is found to mitigate these mean difference extremes. These findings are traced to a tendency for local schemes to incompletely mix the PBL while nonlocal schemes overmix the PBL, whereas the hybrid schemes represent more intermediate mixing in a regime where vertical shear enhances mixing and limited instability suppresses mixing.
Publication date: September 25, 2017
Available online: http://journals.ametsoc.org/doi/abs/10.1175/WAF-D-16-0193.1

ADDITIONAL ARTICLES

OAR Publications

Flow cytometric monitoring of bacterioplankton phenotypic diversity predicts high population-specific feeding rates by invasive dreissenid mussels
Environmental Microbiology (5.395)
R. Props, M. L. Schmidt, J. Heyse, **H. A. VanDerploeg (OAR/GLERL)**, N. Boon, and V. J. Denef

- Our new analysis pipeline led us to the hypothesis that invasive dreissenid mussels directly impact microbial elemental cycling, by driving bacterioplankton communities toward less diverse and less productive states within short time periods.
- Discovering previously undetected important impacts of invasive species on aquatic food webs, specifically on bacteria and their role in nutrient cycling.

Anthropogenic disturbances can lead to rapid changes in microbial community diversity (species richness, evenness and composition). Many studies aim to better understand feedbacks between global change and microbial communities, as changes in microbial diversity can either mitigate the predicted direct effects of disturbances on ecosystem fluxes (Singh et al., 2010; Zhou et al., 2012), or lead to major shifts in bacterially mediated fluxes (Schimel and Gulledge, 1998; Finlay et al., 2007; Levine et al., 2011). The responses of microbial communities to disturbances are often monitored by means of high-throughput molecular techniques, such as 16S rRNA gene amplicon sequencing (Shade et al., 2012). Community shifts in response to altering environmental parameters can occur within hours (Props et al., 2016b) to days (Datta et al., 2016) and demand substantial sampling effort at a preferably fixed frequency to allow accurate statistical inference (Faust et al., 2015). Current technology allows sequencing data to be generated from low-volume samples (e.g., 100 ml) of low-density environments (≤ 106 cells ml−1), which comprise many aquatic ecosystems, but larger sample volumes (> 1 l) are required in order to yield a robust census of the microbial community (Padilla et al., 2015). This prohibits the use of this approach in many longitudinal microcosm studies, for which repeated invasive sampling itself would act as a disturbance.

Publication Date: October 13, 2017
Available online: https://www.ncbi.nlm.nih.gov/pubmed/29027374

The effect of arc proximity on hydrothermal activity along spreading centers

Geochemistry, Geophysics, Geosystems (3.201)

E. T. Baker, **S. L. Walker**, **J. A. Resing**, **W. W. Chadwick, Jr.**, **S. G. Merle**, M.O. Anderson, **D. A. Butterfield**, **N. J. Buck**, and **S. Michael (OAR/PMEL)**

- Exploration of 600 km of the southern Mariana back-arc found 19 active vent sites, 13 more than in the authoritative InterRidge Database.
- Back-arc ridges with high-quality hydrothermal surveys and an adjacent volcanic arc exhibit the highest spatial density of vent sites.
- Vent site spatial density is highest where arc proximity (<~90 km) results in enhanced magma supply to the back-arc ridge.

Back-arc spreading centers (BASCs) form a distinct class of ocean spreading ridges distinguished by steep along-axis gradients in spreading rate and by additional magma supplied through subduction. These characteristics can affect the population and distribution of hydrothermal activity on BASCs compared to mid-ocean ridges (MORs). To investigate this hypothesis we comprehensively explored 600 km of the southern half of the Mariana BASC. We used water column mapping and seafloor imaging to identify 19 active vent sites, an increase of 13 over the current listing in the InterRidge Database (IRDB), on the bathymetric highs of 7 of the 11 segments. We identified both high- and low- (i.e., characterized by a weak or negligible particle plume) temperature discharge occurring on segment types spanning dominantly magmatic to dominantly tectonic. Active sites are concentrated on the two southernmost segments, where distance to the adjacent arc is shortest (<40 km), spreading rate is highest (>48 mm/yr), and tectonic extension is pervasive. Re-examination of hydrothermal data from other BASCs supports the generalization that hydrothermal site density increases on segments <90 km from an adjacent arc. Although exploration quality varies greatly among BASCs, present data suggest that, for a given spreading rate, the mean spatial density of hydrothermal activity varies little between MORs and BASCs. The present global database, however, may be misleading. On both BASCs and MORs, the spatial density of hydrothermal sites mapped by high-quality water-column surveys is 2–7× greater than predicted by the existing IRDB trend of site density vs. spreading rate.

Publication Date: November 30, 2017
Available online: http://onlinelibrary.wiley.com/doi/10.1002/2017GC007234/full

Heating and moistening of the MJO during DYNAMO in ECMWF reforecasts
Journal of the Atmospheric Sciences (3.537)
J.E. Kim, **C. Zhang (OAR-PMEL)**, **G.N. Kiladis (OAR-ESRL)**, and P. Bechtold

- Variables produced by and derived from the IFS reforecast (IFS-RF) agree reasonably well with observations over the DYNAMO sounding arrays, and they vary smoothly from western to eastern equatorial Indian Ocean.
- This lends confidence towards using IFS-RF as a surrogate of observations over the equatorial Indian Ocean outside the DYNAMO arrays.

Reforecasts produced by the ECMWF Integrated Forecasting System (IFS) were used to study heating and moistening processes associated with three MJO events over the equatorial Indian Ocean during the Dynamics of the Madden-Julian Oscillation (DYNAMO) field campaign. Variables produced by and derived from the IFS reforecast (IFS-RF) agree reasonably well with observations over the DYNAMO sounding arrays, and they vary smoothly from western to eastern equatorial Indian Ocean. This lends confidence towards using IFS-RF as a surrogate of observations over the equatorial Indian Ocean outside the DYNAMO arrays. The apparent heat source Q1 and apparent moisture sink Q2 produced by IFS are primarily generated by parameterized cumulus convection, followed by microphysics and radiation. The vertical growth of positive Q1 and Q2 associated with the progression of MJO convection can be gradual, stepwise, or rapid depending on the event and its location over the broader equatorial Indian Ocean. The time for convective heating and drying to progress from shallow (800 hPa) to deep (400 hPa) can be <1 day to 6 days. This growth time of heating and drying is usually short for convective processes alone, but becomes longer when additional microphysical processes, such as evaporative moistening below convective and stratiform clouds, are in play. Three ratios are calculated to measure the possible role of radiative feedback in the MJO events: amplitudes of radiative vs. convective heating rates, changes in radiative vs. convective heating rates, and diabatic (with and without the radiative component) vs. adiabatic heating rates. None of them unambiguously distinguishes the MJO from non-MJO convective events.
Acceptance date: December 7, 2017
Available online: N/A

The role of African dust in Atlantic climate during Heinrich events

Paleoceanography (3.296)

L. N. Murphy, **M. P. Goes (OAR/AOML)**, and A. C. Clement

- Additional Saharan dust causes cooling and freshening of the North Atlantic amplifying Heinrich conditions.
- Under a bistable AMOC state, enhanced Heinrich dust loading can cause an abrupt 20% reduction in AMOC without freshwater input.
- Including both dust and freshwater forcing best matches the magnitude of eastern subtropical Atlantic cooling evident in proxy data.

Increased ice discharge in the North Atlantic is thought to cause a weakening, or collapse, of the Atlantic Meridional Overturning Circulation (AMOC) during Heinrich events. Paleoclimate records indicate these periods were marked by severe tropical aridity and dustiness. Although the driver of these events is still under debate, large freshwater input is necessary for climate models to simulate the magnitude, geographical extent, and abruptness of these events, indicating that they may be missing feedbacks. We hypothesize the dust-climate feedback is one such feedback that has not been previously considered. Here, we analyze the role of dust-climate feedbacks on the AMOC by parameterizing the dust radiative effects in an intermediate complexity model, and consider uncertainties due to wind stress forcing and the magnitude of both atmospheric dust loading and freshwater hosing. We simulate both stable and unstable AMOC regimes by changing the prescribed wind stress forcing. In the unstable regime, additional dust loading during Heinrich events cools and freshens the North Atlantic and abruptly reduces the AMOC by 20% relative to a control simulation. In the stable regime, however, additional dust forcing alone does not alter the AMOC strength. Including both freshwater and dust forcing results in a cooling of the subtropical North Atlantic more comparable to proxy records than with freshwater forcing alone. We conclude that dust-climate feedbacks may provide an amplification to Heinrich cooling by further weakening AMOC and increasing North Atlantic sea ice coverage.

Publication Date: November 30, 2017
Available online:
http://onlinelibrary.wiley.com/doi/10.1002/2017PA003150/abstract

The observed influence of local anthropogenic pollution on northern Alaskan cloud properties
Atmospheric Chemistry and Physics (5.318)
M. Maahn, G. de Boer, J. M. Creamean, G. Feingold (OAR/ESRL), G. M. McFarquhar, W. Wu, and F. Mei

- The researchers find that the concentration of certain air pollution markers is enhanced in the Oliktok Point region.
- Collocated liquid clouds feature a reduction of cloud drop size. The smaller drop size impacts cloud processes and reduces the transformation of cloud drops into drizzle drops, possibly impacting the lifetime of the clouds.

Due to their importance for the radiation budget, liquid-containing clouds are a key component of the Arctic climate system. Depending on season, they can cool or warm the near-surface air. The radiative properties of these clouds depend strongly on cloud drop sizes, which are governed in part by the availability of cloud condensation nuclei. Here, we investigate how cloud drop sizes are modified in the presence of local emissions from industrial facilities at the North Slope of Alaska. For this, we use aircraft in-situ observations of clouds and aerosols from the 5th Department of Energy Atmospheric Radiation Measurement (DOE ARM) Program's Airborne Carbon Measurements (ACME-V) campaign obtained in Summer 2015. Comparison of observations from an area with petroleum extraction facilities (Oliktok Point) with data from a reference area relatively free of anthropogenic sources (Utqiaġvik/Barrow) represents an opportunity to quantify the impact of local industrial emissions on cloud properties. In the presence of local industrial emissions, the mean effective radii of cloud droplets are reduced from 12.2 to 9.4 μm, which leads to suppressed drizzle production and precipitation. At the same time, concentrations of refractory black carbon and condensation nuclei are enhanced below the clouds. These results demonstrate that the effects of anthropogenic pollution on local climate need to be considered when planning Arctic industrial infrastructure in a warming environment.
Publication Date: December 11, 2017
Available Online: https://www.atmos-chem-phys.net/17/14709/2017/acp-17-14709-2017-discussion.html

Designing the climate observing system of the future

Earth's Future (4.938)

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- A significantly expanded climate observing system could address major science questions and meet important societal needs.
- Careful independent testing can evaluate whether proposed systems can address critical observing needs.
- Future investments in climate observations offer large societal benefits and economic return on investments.

Climate observations are needed to address a large range of important societal issues including sea level rise, droughts, floods, extreme heat events, food security, and freshwater availability in the coming decades. Past, targeted investments in specific climate questions have resulted in tremendous improvements in issues important to human health, security, and infrastructure. However, the current climate observing system was not planned in a comprehensive, focused manner required to adequately address the full range of climate needs. A potential approach to planning the observing system of the future is presented in this paper. First, this paper proposes that priority be given to the most critical needs as identified within the World Climate Research Program as Grand Challenges. These currently include seven important topics: Melting Ice and Global Consequences; Clouds, Circulation and Climate Sensitivity; Carbon Feedbacks in the Climate System; Understanding and Predicting Weather and Climate Extremes; Water for the Food Baskets of the World; Regional Sea-Level Change and Coastal Impacts; and Near-term Climate Prediction. For each Grand Challenge, observations are needed for long-term monitoring, process studies and forecasting capabilities. Second, objective evaluations of proposed observing systems, including satellites, ground-based and in situ observations as well as potentially new, unidentified observational approaches, can quantify the ability to address these climate priorities. And third, investments in effective climate observations will be

economically important as they will offer a magnified return on investment that justifies a far greater development of observations to serve society's needs.
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Spatially distinct, temporally stable microbial populations mediate biogeochemical cycling at and below the seafloor in hydrothermal vent fluids
Environmental Microbiology (5.932)
C. S. Fortunato, **B. Larson**, **D. A. Butterfield (OAR/PMEL)**, and J. A. Huber

- This study is the first to assess both the taxonomic and metabolic fingerprints of microbial communities from hydrothermal vent diffuse fluids across multiple vents and years and lends important insight into the connection between microbial metabolisms, fluid chemistry, and microbial population dynamics at and below the seafloor.
- Results revealed that microbial community structure and function are spatially dynamic, vent-specific, and shaped by both fluid chemistry and physical characteristics of individual vents.
- This study broadens our knowledge of microbial metabolic function at and below the seafloor and provides new insights into the biogeochemical role microbes play in these underexplored ecosystems.

At deep-sea hydrothermal vents, microbial communities thrive across geochemical gradients above, at, and below the seafloor. In this study, we determined the gene content and transcription patterns of microbial communities and specific populations to understand the taxonomy and metabolism both spatially and temporally across geochemically different diffuse fluid hydrothermal vents. Vent fluids were examined via metagenomic, metatranscriptomic, genomic binning, and geochemical analyses from Axial Seamount, an active submarine volcano on the Juan de Fuca Ridge in the NE Pacific Ocean, from 2013-2015 at three different vents: Anemone, Marker 33, and Marker 113. Results showed that individual vent sites maintained microbial communities and specific populations over time, but with spatially distinct taxonomic, metabolic potential, and gene transcription profiles. The geochemistry and physical structure of each vent both played important roles in shaping the dominant organisms and metabolisms present at each site. Genomic binning identified key populations of SUP05, Aquificales, and methanogenic archaea carrying out important transformations of carbon, sulfur,

hydrogen, and nitrogen, with groups that appear unique to individual sites. This work highlights the connection between microbial metabolic processes, fluid chemistry, and microbial population dynamics at and below the seafloor and increases understanding of the role of hydrothermal vent microbial communities in deep ocean biogeochemical cycles.
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Agreement of CMIP5 simulated and observed ocean anthropogenic CO2 uptake
Geophysical Research Letters (4.456)
B. Bronselaer, M. Winton, J. Russell, **C. L. Sabine (OAR/PMEL)**, and S. Khatiwala

- Previous observations and model simulations of ocean anthropogenic carbon assume different start dates possibly causing differing estimates in historical ocean anthropogenic carbon uptake.
- Once referenced to the same period, 1971- 1995, models and observations of ocean anthropogenic carbon agree to within 4%.

Previous studies found large biases between individual observational and model estimates of historical ocean anthropogenic carbon uptake. We show that the largest bias between the Coupled Model Intercomparison Project phase 5 (CMIP5) ensemble mean and between two observational estimates of ocean anthropogenic carbon is due to a difference in start date. After adjusting the CMIP5 and observational estimates to the 1791-1995 period, all three carbon uptake estimates agree to within 3 Pg of C, about 4% of the total. The CMIP5 ensemble mean spatial bias compared to the observations is generally smaller than the observational error, apart from a negative bias in the Southern Ocean, and a positive bias in the Southern Indian and Pacific Oceans compensating each other in the global mean. This dipole pattern is likely due to an equatorward and weak bias in the position of Southern Hemisphere westerlies and lack of mode and intermediate water ventilation.
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Heterogeneity of methane seep biomes in the northeast Pacific
Deep Sea Research Part II: Topical Studies in Oceanography (1.713)
S. Seabrook, F. De Leo, **T. Baumberger** (OAR/PMEL), N. Raineault, and A.R. Thurber

- The paper examined 8 newly discovered seeps and 2 known seeps covering 800 km and varying across 2000m water depth.
- The microbial communities showed high variability in their spatial distribution and community structure.
- Overall, our results demonstrate that heterogeneity is ubiquitous in the seep biome, spanning all faunal classes, and that the understanding of seeps and the drivers of the community structure can be improved by studying seeps at a range of spatial scales.

Methane seeps provide biogeochemical and microbial heterogeneity in deep-sea habitats. In the Northeast (NE) Pacific Ocean recent studies have found an abundance of seeps at varying spatial separations and within distinct biogeochemical environments ranging in oxygen, depth, and temperature. Here, we examine 8 newly discovered seeps and 2 known seeps covering 800 km and varying across 2000m water depth to identify: (1) novel megafaunal communities in this geographical region; (2) variations in the microbiome of seep habitats across the margin; (3) spatial and biogeochemical drivers of microbial diversity at seeps. In addition to authigenic carbonates, clam beds, microbial mats, and exposed hydrates - we also observed Siboglinidae tube worm bushes and an anomalous deep-sea barnacle adding to the overall habitats known from the NE Pacific. The microbial communities showed high variability in their spatial distribution and community structure. The seep communities formed distinct groups that included multiple groups of anaerobic methane oxidizing Archaea (ANME; 1, 2ab, 2c, and 3), often co-occurring within one site – however, there were also other sites with clearly dominant members (e.g. ANME-1s at Nehalem Bank). Sulfide oxidizers were dominated by the non-mat forming Campylobacterales and even though vertical gradients in redox potential typify seep sediments, in two cases there was not a significant change in community structure across the top 5 cm of sediment. We posit that these patterns were driven by 'bubble-turbation,' and bioirrigation by megafauna. A surprising latitudinal trend was observed in species diversity and

richness with increasing richness significantly correlated to increasing latitude. Overall, our results demonstrate that heterogeneity is ubiquitous in the seep biome, spanning all faunal classes, and that the understanding of seeps and the drivers of the community structure can be improved by studying seeps at a range of spatial scales.
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Volatility of Tornadogenesis: An ensemble of simulated nontornadic and tornadic supercells in VORTEX2 environments
AMS Monthly Weather Review (3.043)
B. Coffer, M. Parker, J. Dahl, **L. Wicker**, and **A. Clark (OAR/NSSL)**

- The paper is significant because despite our successes with forecasting - we still have a hard time discriminating exactly what makes an environment prolifically tornadic. The ensemble results provide convincing evidence that there is something we can still learn by carefully inspecting the environment.
- An analysis of the tornadic ensemble shows the most important component of the flow is that each storm features a steady low-level mesocyclone due to the ingestion of predominately streamwise horizontal vorticity.
- The paper's results have generated a new research effort with scientists at NSSL and is a potential game changer via trying to take these results and apply them to operational storm-scale models.

An analysis of the tornadic ensemble shows the most important component of the flow is that each storm features a steady low-level mesocyclone due to the ingestion of predominately streamwise horizontal vorticity. This configuration of the low-level mesocyclone provides a persistent area of strong upward dynamic lifting to contract and stretch the sub-cloud vertical vorticity into a tornado. This fundamental attribute of the VORTEX2 tornadic composite environment (highly streamwise lower-tropospheric horizontal vorticity) seems to strongly favor tornadic supercells. Ultimately, an understanding of how environmental ingredients link to the predictability of tornadic versus nontornadic storms will require studies that span a much broader range of the supercell spectrum than what is represented by the VORTEX2 composite environments.

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The combined effects of acidification and hypoxia on pH and aragonite saturation in the coastal waters of the Californian Current Ecosystem and the northern Gulf of Mexico

Continental Shelf Research (2.064)

R. A. Feely (OAR/PMEL), R. R. Okazaki, W. -J. Cai, N. Bednaršek, **S. R. Alin** (OAR/PMEL), R. H. Byrne, and A. Fassbender

- In surface waters the percentage change in the carbon parameters due to increasing CO2 emissions are similar.
- In subsurface waters the changes are enhanced due to changes in the buffer capacity.
- Increased anthropogenic CO2 concentrations will expose organisms to hypercapnic conditions.

Inorganic carbon chemistry data from the surface and subsurface waters of the West Coast of North America have been compared with similar data from the northern Gulf of Mexico to demonstrate how future changes in CO2 emissions will affect chemical changes in coastal waters affected by respiration-induced hypoxia ([O2] ≤ ~60 µmol kg−1). In surface waters, the percentage change in the carbon parameters due to increasing CO2 emissions are very similar for both regions even though the absolute decrease in aragonite saturation is much higher in the warmer waters of the Gulf of Mexico. However, in subsurface waters the changes are enhanced due to differences in the initial oxygen concentration and the changes in the buffer capacity (i.e., increasing Revelle Factor) with increasing respiration from the oxidation of organic matter, with the largest impacts on pH and CO2 partial pressure (pCO2)

occurring in the colder waters. As anthropogenic CO2 concentrations begin to build up in subsurface waters, increased atmospheric CO2 will expose organisms to hypercapnic conditions (pCO2 >1000 µatm) within subsurface depths. Since the maintenance of the extracellular pH appears as the first line of defense against external stresses, many biological response studies have been focused on pCO2–induced hypercapnia. The extent of subsurface exposure will occur sooner and be more widespread in colder waters due to their capacity to hold more dissolved oxygen and the accompanying weaker acid–base buffer capacity. Under present conditions, organisms in the West Coast are exposed to hypercapnic conditions when oxygen concentrations are near 100 µmol kg−1 but will experience hypercapnia at oxygen concentrations of 260 µmol kg−1 by year 2100 under the highest elevated–CO2 conditions. Hypercapnia does not occur at present in the Gulf of Mexico but will occur at oxygen concentrations of 170 µmol kg−1 by the end of the century under similar conditions. The aragonite saturation horizon is currently above the hypoxic zone in the West Coast. With increasing atmospheric CO2, it is expected to shoal up close to surface waters under the IPCC Representative Concentration Pathway (RCP) 8.5 in West Coast waters, while aragonite saturation state will exhibit steeper gradients in the Gulf of Mexico. This study demonstrates how different biological thresholds (e.g., hypoxia, CaCO3 undersaturation, hypercapnia) will vary asymmetrically because of local initial conditions that are affected differently with increasing atmospheric CO2. The

direction of change in amplitude of hypercapnia will be similar in both ecosystems, exposing both biological communities from the West Coast and Gulf of Mexico intensification of stressful conditions. However, the region of lower Revelle factors (i.e., the Gulf of Mexico), currently provides an adequate refuge habitat that might no longer be the case under the most severe RCP scenarios.

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Anomalous blocking over Greenland preceded the 2013 extreme early melt of local sea ice

Annals of Glaciology (2.349)

T. Ballinger, E. Hanna, R. J. Hall, T. E. Cropper, J. Miller, M. H. Ribergaard, **J. E. Overland (OAR/PMEL)**, and J. L. Høyer

- This study investigates the possible causes of an extremely early melt event in the Baffin Bay-Davis Strait-Labrador Sea region.
- A strong anticyclone over Greenland occurred during the 40-day period before the 2013 melt event which is expected to bring warm are into the region.
- These findings show the cause of an extreme event in an area which is experiencing persistently earlier melting in recent decades.

The Arctic marine environment is undergoing a transition from thick multi-year to first-year sea-ice cover with coincident lengthening of the melt season. Such changes are evident in the Baffin Bay-Davis Strait-Labrador Sea (BDL) region where melt onset has occurred ~8 days decade^{-1} earlier from 1979 to 2015. A series of anomalously early events has occurred since the mid-1990s, overlapping a period of increased upper-air ridging across Greenland and the northwestern North Atlantic. We investigate an extreme early melt event observed in spring 2013. (~6σ below the 1981–2010 melt climatology), with respect to preceding sub-seasonal mid-tropospheric circulation conditions as described by a daily Greenland Blocking Index (GBI). The 40-days prior to the 2013 BDL melt onset are

characterized by a persistent, strong 500 hPa anticyclone over the region (GBI >+1 on >75% of days). This circulation pattern advected warm air from northeastern Canada and the northwestern Atlantic poleward onto the thin, first-year sea ice and caused melt ~50 days earlier than normal. The episodic increase in the ridging atmospheric pattern near western Greenland as in 2013, exemplified by large positive GBI values, is an important recent process impacting the atmospheric circulation over a North Atlantic cryosphere undergoing accelerated regional climate change.
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Available online: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/3D3D28D1B083F54DB2C6C82DC1DDE3CA/S0260305517000301a.pdf/anomalous_blocking_over_greenland_preceded_the_2013_extreme_early_melt_of_local_sea_ice.pdf

Axisymmetric initialization of the atmosphere and ocean for idealized coupled hurricane simulations
Journal of Advances in Modeling Earth Systems (4.189)
A. Aksoy, **J. Zhang**, **B. W. Klotz**, E. W. Uhlhorn, and **J. J. Cione (OAR/AOML)**

- The speed at which a tropical cyclone moves is most important in controlling what is happening in the ocean below the storm.
- Changes in the upper-ocean are controlled by the center of the storm, with little impact on mixed-layer depth and temperature changes outside the inner core.
- Other details of the tropical cyclone are less important in controlling what is happening in the ocean below the storm.

A new vortex-scale initialization scheme is presented for idealized coupled hurricane simulations. The atmospheric scheme involves construction of averaged kinematic and thermodynamic initial fields based on historical composite datasets from hurricane reconnaissance aircraft. For ocean initialization, a statistical scheme is proposed to construct regression models among atmospheric and ocean fields in the hurricane inner core. For the numerical model, the Hurricane Weather Research and Forecasting (HWRF) model coupled with a one-dimensional, diffusive ocean model is used with modifications to initialize with the observation-based vortex

and to ensure that the storm environment remains approximately steady. The primary goal in these simulations is to obtain steady-state hurricanes of category-1 intensity with characteristics typically observed during the hurricane season of the Western Atlantic and Caribbean Sea regions. It is demonstrated that this is successfully achieved in the simulations. In an azimuthally averaged sense, regression models are found to capture about 70% of total variance for sea-surface temperature cooling and up to 55% of total variance for mixed-layer depth perturbation in the hurricane inner core. Furthermore, within the inner core of a hurricane vortex, it is found that storm speed contributes most to upper-ocean perturbations, whereas characteristics of the atmospheric vortex contribute very little. The importance of storm speed in controlling upper-ocean perturbations is strongest near the storm center, diminishing gradually toward no measurable impact beyond the immediate inner core.
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Rewriting the tropical record books: The extraordinary intensification of Hurricane Patricia (2015)
Bulletin of the American Meteorological Society (11.808)
R. F. Rogers, **S. Aberson (OAR/AOML)**, M. M. Bell, D. J. Cecil, J. D. Doyle, T. B. Kimberlain, J. Morgerman, L. K. Shay, and C. Velden

- Hurricane Patricia broke records in 2015 during its brief lifetime (4 days) in the eastern Pacific Basin.
- Traditional and new data sources collected via airborne missions before and during peak intensity provided information that could improve forecasts of tropical cyclone rapid intensity changes.

Hurricane Patricia was a historic tropical cyclone that broke many records, such as intensification rate, peak intensity, and overwater weakening rate, during its brief 4-day lifetime in late October 2015 in the eastern Pacific basin. Patricia confounded all of the intensity forecast guidance owing to its rapid intensity changes. Fortunately, the hurricane-penetrating National Oceanic and Atmospheric Administration WP-3D and U.S. Air Force C-130 aircraft and the National Aeronautics and Space Administration WB-57 high-altitude jet, under support of the Office of Naval Research, conducted missions through and over Patricia prior

to and during its extreme intensity changes on all 4 days, while an extensive array of pressure sensors sampled Patricia after landfall. The observations collected from these missions include traditional data sources such as airborne Doppler radar and flight-level instruments as well as new data sources like a high-density array of dropsondes released from high-altitude and wide-swath radiometer. The combination of data from these sources and from satellites provides an excellent opportunity to investigate the physical processes responsible for Patricia's structure and evolution and offers the potential to improve forecasts of tropical cyclone rapid intensity changes. This paper provides an overview of Patricia as well as the data collected during the aircraft missions.
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Cyanate distribution and uptake above and within the Eastern Tropical South Pacific oxygen deficient zone
Limnology and Oceanography (3.794)
B. Widner, **C. W. Mordy (OAR/PMEL)**, and M. R. Mulholland

- Cyanate is a reduced nitrogen compound that can be a source of nitrogen and carbon for marine organisms and also act as a substrate for dissimilatory nitrogen processes (nitrification and annamox).
- Measurements of cyanate distributions in the Eastern Tropical South Pacific suggests that cyanate may play a role in the metabolism of anaerobic microbes and in the annamox reaction.

Cyanate is a simple reduced nitrogen (N) compound that can be a source of N and carbon (C) for marine organisms and may also be a substrate for dissimilatory N processes such as nitrification and anammox. We measured cyanate distributions and cyanate and urea uptake in the Eastern Tropical South Pacific, a region defined by coastal upwelling, high primary productivity, a shallow oxic layer, and rapid N loss from a large oxygen deficient zone (ODZ). Cyanate concentrations ranged from below the limit of detection (0.4 nM) to 45 nM in the oxic upper water column. Below the oxycline, cyanate concentrations were largely below detection except for small cyanate peaks (2–8.3 nM) within the core of the ODZ at some stations. The majority of N taken up in the shallow oxic layer was from ammonium

and urea (78% ± 8%); cyanate uptake was < 2% of these. Uptake of cyanate fluctuated diurnally with the highest rates of cyanate N uptake in the early afternoon. In the ODZ, rates of cyanate, urea, and ammonium uptake were similar to each other (0.1–14 nmol N L^{-1} d^{-1}) and to previously reported rates of $^{29}N_2$ production supported by cyanate and ammonium (3–14 nmol N_2 L^{-1} d^{-1}). This suggests a role for cyanate in the metabolism of anaerobic microbes and a potential role for cyanate in the anammox reaction (cyanammox). To our knowledge, these represent the first rates of N uptake in a marine anoxic water column.
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A census of atmospheric variability from seconds to decades
Geophysical Research Letters (4.253)
P. D. Williams, M. J. Alexander, E. A. Barnes, **A. H. Butler (OAR/ESRL)**, H. C. Davies, C. I. Garfinkel, Y. Kushnir, T. P. Lane, J. K. Lundquist, O. Martius, R. N. Maue, W. R. Peltier, K. Sato, A. A. Scaife, and **C. Zhang (OAR/PMEL)**

- This paper synthesizes and summarizes the variability of the atmosphere on all time scales through a phenomenological census.
- It provides an authoritative, concise, and accessible point of reference for the most important modes of atmospheric variability.

This paper synthesizes and summarizes atmospheric variability on time scales from seconds to decades through a phenomenological census. We focus mainly on unforced variability in the troposphere, stratosphere, and mesosphere. In addition to atmosphere-only modes, our scope also includes coupled modes, in which the atmosphere interacts with the other components of the Earth system, such as the ocean, hydrosphere, and cryosphere. The topics covered include turbulence on time scales of seconds and minutes, gravity waves on time scales of hours, weather systems on time scales of days, atmospheric blocking on time scales of weeks, the Madden–Julian Oscillation on time scales of months, the Quasi-Biennial Oscillation and El Niño–Southern Oscillation on time scales of years, and the North Atlantic, Arctic, Antarctic, Pacific Decadal, and Atlantic Multidecadal Oscillations on time scales of decades. The paper serves as an introduction to a special collection of Geophysical Research Letters on atmospheric variability. We

hope that both this paper and the collection will serve as a useful resource for the atmospheric science community and will act as inspiration for setting future research directions.
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Complementary use of glider data, altimetry, and model for exploring mesoscale eddies in the tropical Pacific Solomon Sea
Journal of Geophysical Research: Oceans (2.939)
L. Gourdeau, J. Verron, A. Chaigneau, S. Cravatte, and **W. Kessler (OAR-PMEL)**

- Researchers use glider data, altimetry, and high-resolution model to explore mesoscale eddies, especially their vertical structures, and their role on the Solomon Sea circulation.
- The description of individual eddies observed by altimetry and gliders allows researchers to characterize the 3D structure of these tropical eddies, and confirms the usefulness of the model to access a more universal view of such eddies.
- These mesoscale eddies are an important component of the Solomon Sea circulation that can affect the low latitude western boundary currents of the South tropical Pacific Ocean carrying waters of subtropical origin before joining the equatorial Pacific.

Mesoscale activity is an important component of the Solomon Sea circulation that interacts with the energetic low latitude western boundary currents of the South tropical Pacific Ocean carrying waters of subtropical origin before joining the equatorial Pacific. Mixing associated with mesoscale activity could explain water mass transformation observed in the Solomon Sea that likely impacts El Niño Southern Oscillation dynamics. This study makes synergetic use of glider data, altimetry, and high-resolution model for exploring mesoscale eddies, especially their vertical structures, and their role on the Solomon Sea circulation. The description of individual eddies observed by altimetry and gliders provides the first elements to characterize the 3D structure of these tropical eddies, and confirms the usefulness of the model to access a more universal view of such eddies. Mesoscale

eddies appear to have a vertical extension limited to the Surface Waters (SW) and the Upper Thermocline Water (UTW), i.e. the first 140-150 m depth. Most of the eddies are nonlinear, meaning that eddies can trap and transport water properties. But they weakly interact with the deep New Guinea Coastal Undercurrent that is a key piece of the equatorial circulation. Anticylonic eddies are particularly efficient to advect salty and warm SW coming from the intrusion of equatorial Pacific waters at Solomon Strait, and to impact the characteristics of the New Guinea Coastal Current. Cyclonic eddies are particularly efficient to transport South Pacific Tropical Water (SPTW) anomalies from the North Vanuatu Jet and to erode by diapycnal mixing the high SPTW salinity.
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NMFS Publications

Rethinking 'normal': The role of stochasticity in the phenology of a synchronously breeding seabird
Journal of Animal Ecology (4.474)
C. Youngflesh, S. Jenouvrier, **J. T. Hinke (NMFS/SWFSC)**, L. DuBois, J. St. Leger, W. Z. Trivelpiece, S. G. Trivelpiece, and H. J. Lynch

- Phenological changes over time may cause mis-matched ecological interactions with negative consequences for ecological function
- Phenological variability can be generated in the absence of environmental variability.
- Accordingly, we must be careful to consider random forcing in phenological processes, lest we fit models to data dominated by random noise.

Phenological changes have been observed in a variety of systems over the past century. There is concern that, as a consequence, ecological interactions are becoming increasingly mismatched in time, with negative consequences for ecological function. Significant spatial heterogeneity (inter-site) and temporal variability (inter-annual) can make it difficult to separate intrinsic, extrinsic, and stochastic drivers of phenological variability. The goal of this study was to understand the timing and variability of breeding phenology of Adélie penguins under fixed environmental conditions, and to use those data to identify a 'null model' appropriate for disentangling the sources of variation in wild populations.

Data on clutch initiation were collected from both wild and captive populations of Adélie penguins. Clutch initiation in the captive population was modeled as a function of year, individual, and age to better understand phenological patterns observed in the wild population. Captive populations displayed as much inter-annual variability in breeding phenology as wild populations, suggesting that variability in breeding phenology is the norm and an unreliable indicator of environmental forcing. The distribution of clutch initiation dates within a population was found to be asymmetric (right skewed). This suggests that synchrony in breeding among individuals might cause females to accelerate clutch initiation in response to the earliest breeders. We conclude that breeding phenology in Adélie penguins is largely driven by the initiation of breeding by the earliest breeders in the colony, whose timing is stochastic in nature. While some individuals always breed slightly earlier than others, the effect of age on phenology was weak. Stochasticity in breeding phenology appears to be independent of any environmental or demographic drivers of interannual variability, which complicates efforts to relate phenological variation to environment variability in the wild. Accordingly, we must be careful to consider random forcing in phenological processes, lest we fit models to data dominated by random noise. This is particularly true for colonial species where breeding synchrony may outweigh each individual's effort to time breeding with optimal environmental conditions. Our study highlights the importance of identifying appropriate null models for studying phenology.
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Available online: N/A

Simulated juvenile salmon growth and phenology respond to altered thermal regimes and stream network shape
Ecosphere (2.287)
A. H. Fullerton (NMFS/NWFSC), **B. J. Burke (NMFS/NWFSC)**, J. J. Lawler, C. E. Torgersen, J. L. Ebersole, and S. G. Leibowitz

- Stream network structure may influence species response to climate change

It is generally accepted that climate change will stress coldwater species like Pacific salmon. However, it is unclear what aspect of altered thermal regimes (e.g., warmer winters, springs, summers, or increased variability) will have the greatest

effect, and what role the spatial properties of river networks play. Thermally diverse habitats may afford protection from climate change by providing opportunities for aquatic organisms to find and use habitats with optimal conditions for growth. We hypothesized that climate-altered thermal regimes will change growth and timing of life history events such as emergence or migration but that changes will be moderated in topologically complex stream networks where opportunities to thermoregulate are more readily available to mobile animals. Because climate change effects on populations are spatially variable and contingent upon physiological optima, assessments of risk must take a spatially explicit approach. We developed a spatially-structured individual based model for Chinook Salmon (*Oncorhynchus tshawytscha*) in which movement decisions and growth were governed by water temperature and conspecific density. We evaluated growth and phenology (timing of egg emergence and smolting) under a variety of thermal regimes (each having a different minimum, rate of warming, maximum, and variability) and in three network shapes of increasing spatial complexity. Across networks, fish generally grew faster and were capable of smolting earlier in warmer scenarios where water temperatures experienced by fish were closer to optimal; however, growth decreased for some fish. We found that salmon size and smolt date responded more strongly to warmer springs and summers than to warmer winters or increased variability. Fish in the least complex network grew faster and were ready to smolt earlier than fish in the more spatially complex network shapes in the contemporary thermal regime; patterns were similar but less clear in warmer thermal regimes. Our results demonstrate that network topology may influence how fish respond to thermal landscapes, and this information will be useful for incorporating a spatiotemporal context into conservation decisions that promote long-term viability of salmon in a changing climate.
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Available online: N/A

Size-conditional smolting and the response of Carmel River steelhead to two decades of conservation efforts
PLoS One (3.057)
J. Lopez Arriaza, **D. A. Boughton (NMFS/SWFSC)**, K. Urquhart, and M. Mangel

- The decline of anadromous steelhead abundance in the Carmel River is explained by a decline in growth rates of juvenile steelhead since a reduced growth rate was found to decrease survival.
- Efforts to improve survival of juvenile steelhead through translocations did not appear to mitigate the decline, but captive rearing of juvenile fish did appear to partially mitigate the decline, due to robust growth rates in the rearing facility.

Threshold effects are common in ecosystems and can generate counterintuitive outcomes in management interventions. A threshold effect proposed for steelhead trout (*Oncorhynchus mykiss*) is size-conditional smolting and marine survival. Steelhead are anadromous, maturing in the ocean but migrating to freshwater to spawn, where their offspring reside for one or more years before smolting—physiologically transforming to a saltwater form—and migrating to the ocean. In conditional smolting, juveniles transform only if growth exceeds a threshold body size prior to migration season, and subsequent marine survival correlates with size at ocean entry. Conditional smolting suggests that efforts to improve freshwater survival of juveniles may reduce smolt success if they increase competition and reduce growth. Using model-selection techniques, we asked if this effect explained declining numbers of adult Carmel River steelhead. This threatened population has been the focus of two decades of habitat restoration, as well as active translocation and captive-rearing of juveniles stranded in seasonally dewatered channels. In the top-ranked model selected by information-theoretic criteria, adult decline was linked to reduced juvenile growth rates in the lower river, consistent with the conditional smolting hypothesis. According to model inference, since 2005 most returning adult steelhead were captively-reared. However, a lower-ranked model without conditional smolting also had modest support, and suggested a negative effect of captive rearing. Translocations of juvenile fish to perennial reaches may have reduced the steelhead run slightly by raising competition, but this effect is confounded in the data with effects of river flow on growth. Efforts to recover Carmel River steelhead will probably be more successful if they focus on conditions promoting rapid growth in the river. Our analysis clearly favored a role for size-conditional smolting and marine survival in the decline of the population, but did not definitively rule out alternative explanations.

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Age-based and reproductive biology of the Pacific Longnose Parrotfish Hipposcarus longiceps *from Guam*
PeerJ (2.2)
B. M. Taylor (NMFS/PIFSC), and **E. Cruz (NMFS/PIFSC)**

- High resolution information for immediate use in ongoing stock assessments.
- Update of previous vulnerability models based on life history information.
- Confirmation of protogynous hermaphroditism as sexual pattern for highly targeted.

The Pacific longnose parrotfish *Hipposcarus longiceps* (Valenciennes 1840) represents a prime fishery resource throughout much of the tropical Pacific. In this study, we sampled the species from the Guam commercial fishery market across five consecutive years to characterize reproductive and age-based demographic information imperative for informed fishery management. Compared with other parrotfishes, this species was found to be large-bodied, but has only a moderate life span of 10 + years. *Hipposcarus longiceps* was confirmed as a diandric protogynous hermaphrodite with highly sex-specific growth patterns and an overall mean asymptotic length of 434 mm fork length (FL). Females were estimated to reach median maturity at 329 mm FL (2.4 years) and have a median length at female-to-male sex change of 401 mm FL. Life-history trait values derived here were used to update previous models relating life history and vulnerability to overexploitation. We found that enhancement of just one species' trait values improved model fits considerably, which strengthens the conclusion that life-history traits are a strong determinant of species' vulnerability in the parrotfishes. This information is an imperative complement to other data sources facilitating formal stock assessment of a key fishery target.
Publication date: November 29, 2017
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Comparative growth, age at maturity and sex change, and longevity of Hawaiian parrotfishes, with bomb radiocarbon validation

Canadian Journal of Fisheries and Aquatic Sciences (2.437)

E. E. DeMartini, **A. H. Andrews**, K. G. Howard, **B. M. Taylor (NMFS/PIFSC)**, D. Lou, and M. K. Donovan

- This study compared the growth rates and longevities for five major fishery species of parrotfishes at Oahu, Hawai'i.
- Longevities were found to range broadly among the three small species, 4, 6 and 11 years, and to 15–20 years for the two large species.
- Estimated milestones poorly corresponded to the current minimum legal size for uhu in Hawai'i (12 in. or 30.5 cm fork length).
- Pooling these parrotfishes for management seems generally inappropriate, especially for the two large species.

Growth rates and longevities were estimated for five major fishery species of parrotfishes ("uhu") at Oahu, Hawai'i. All species grew rapidly with von Bertalanffy growth formula k values $\geq 0.4 \cdot year^{-1}$. Longevities were found to range broadly among the three small species, 4 years in *Calotomus carolinus* and 6 and 11 years in *Scarus psittacus* and *Chlorurus spilurus,* and to 15–20 years in *Scarus rubroviolaceus* and *Chlorurus perspicillatus* for the two large species. Age reading and growth curves for the latter two large species were validated using bomb radiocarbon dating. Median ages at sexual maturity as females (A_{M50}) and at sex change (from female to terminal phase male, $A_{\Delta}50$) were estimated using logistic models. Sexual maturation occurred at 1–2 years for the small species and at 3–3.5 years in the large species. $A_{\Delta 50}$ estimates ranged from 2 to 4 years in the small species and were about 5 and 7 years in *S. rubroviolaceus* and *C. perspicillatus*, respectively. Estimated milestones poorly corresponded to the current minimum legal size for uhu in Hawai'i (12 in. or 30.5 cm fork length). Pooling these parrotfishes for management seems generally inappropriate, especially for the two large species. Age-based metrics are more informative than size-based metrics for these fishes.

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Movement and survival of wild Chinook salmon smolts from Butte Creek during their outmigration to the ocean: Comparison of a dry versus wet year
Transactions of the American Fisheries Society (1.469)
F. Cordoleani, **J. Notch**, **A. S. McHuron**, **A. J. Ammann**, and **C. J. Michel (NMFS/SWFSC)**

- The impact of different weather conditions on an important population of spring-run Chinook Salmon using acoustic telemetry and mark-recapture were tested.
- A dry year resulted in slower out-migration to the ocean and had lower survival than a wet year with further variation based on location.
- This study could inform restoration efforts and water management in the future.

California's Central Valley (CCV) Chinook Salmon (*Oncorhynchus tshawytscha*) stocks have declined substantially since the mid-1800s with most listed as threatened or endangered, or heavily supplemented by hatcheries. As the largest population of CCV wild spring-run Chinook Salmon, Butte Creek fish are an important source for promoting life history diversity in the CCV Chinook Salmon community. However, little information exists on Butte Creek juvenile mortality during out-migration to the ocean, which is considered a critical phase in the overall population dynamics. We used the Juvenile Salmon Acoustic Telemetry System (JSATS) to track the movement of individual fish, and a mark-recapture modeling framework to estimate survival of migrating wild Chinook Salmon smolts from lower Butte Creek to ocean entry at the Golden Gate Bridge. Survival and migration varied significantly among years; in 2015, a dry year, Chinook Salmon smolts migrated slower throughout their migratory corridor and exhibited lower survival than in a wetter year (2016), and among locations; fish migrated faster and experienced higher survival in the lower Sacramento River than in the Sutter Bypass and the Delta. Our data suggests that higher flow at release and larger fish lengths both resulted in increased survival. Our findings have shed light on a critical phase of the wild spring-run juvenile Chinook Salmon dynamics and could help inform future restoration and management projects that would improve the survival and abundance of the CCV spring-run Chinook Salmon populations.

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Fishery collapse, recovery, and the cryptic decline of wild salmon on a major California river

Canadian Journal of Fisheries and Aquatic Sciences (2.437)

M. Willmes, J. A. Hobbs, A. M. Sturrock, Z. Bess, L. S. Lewis, J. J. Glessner, **R. C. Johnson (NMFS/ SWFSC)**, R. Kurth, and J. Kindopp

- This study looked at the contribution of hatchery reared fish to the Fall-run Chinook salmon population in the Sacramento-San Joaquin River system using otolith stable isotopes.
- From 2002 to 2012, hatchery salmon were between 50-90% of the population, with more recent years having more hatchery fish.
- Observed evidence of the recovery may actually show replacement of wild spawners with hatchery fish, affecting population diversity.

Fall-run Chinook salmon (*Oncorhynchus tshawytscha*) from the Sacramento-San Joaquin River system form the backbone of California's salmon fishery and are heavily subsidized through hatchery production. Identifying the contribution and temporal trends of hatchery salmon is vital for assessing the status and resiliency of wild salmon populations. Here, we reconstructed the hatchery contribution to the natural spawning grounds on the Feather River, a major tributary to the Sacramento River, using strontium isotope (87Sr/86Sr) ratios of fish otoliths collected during carcass surveys from 2002 to 2010. Our results show that in the Feather River a large proportion (~50-90%) of in-river spawners were of hatchery origin, and that hatchery contributions increased in 2009-2010 after the salmon stock collapse. Recent data from a hatchery marking program show hatchery fish continuing to dominate (~90%) over the following two years (2011 and 2012). While the overall salmon abundance basin-wide suggests recovery of the stock after the collapse, these data document a replacement of wild spawners with hatchery origin salmon on the Feather River, leading to erosion of locally adapted salmon populations.

An analytical approach to sparse telemetry data
PloS one (2.806)
M. J. Kinney, **D. Kacev**, **S. Kohin**, and **T. Eguchi (NMFS/SWFSC)**

- A Bayesian modeling framework is presented to analyze telemetry data, particularly for sparse, difficult-to-obtain data of highly migratory marine species.
- A permuted Random Forest analysis determines the environmental variables of importance to movement, followed by Markov Chain Monte Carlo simulations to ultimately develop movement models.
- This Bayesian approach is shown to be capable of strong predictions even when tagging data is minimal and can be broadly applied in future telemetry analyses.
- Data-limited telemetry studies can still provide quantitative population level inferences and such should strive to do so rather than assuming data paucity dictates the use of more qualitative descriptive approaches.

Horizontal behavior of highly migratory marine species is difficult to decipher because animals are wide-ranging, spend minimal time at the ocean surface, and utilize remote habitats. Satellite telemetry enables researchers to track individual movements, but population level inferences are rare due to data limitations that result from difficulty of capture and sporadic tag reporting. We introduce a Bayesian modeling framework to address population level questions with satellite telemetry data when data are sparse. We also outline an approach for identifying informative variables for use within the model. We tested our modeling approach using a large telemetry dataset for Shortfin Makos (*Isurus oxyrinchus*), which allowed us to assess the effects of various degrees of data paucity. First, a permuted Random Forest analysis is implemented to determine which variables are most informative. Next, a generalized additive mixed model is used to help define the relationship of each remaining variable with the response variable. Using jags and rjags for the analysis of Bayesian hierarchical models using Markov Chain Monte Carlo simulation, we then developed a movement model to generate parameter estimates for each of the variables of interest. By randomly reducing the tagging dataset by 25, 50, 75, and 90 percent and recalculating the parameter estimates, we demonstrate that the proposed Bayesian approach can be applied in

data-limited situations. We also demonstrate how two commonly used linear mixed models with maximum likelihood estimation (MLE) can be similarly applied. Additionally, we simulate data from known parameter values to test each models ability to recapture those values. Despite performing similarly, we advocate using the Bayesian over the MLE approach due to the ability for later studies to easily utilize results of past study to inform working models, and the ability to use prior knowledge via informed priors in systems where such information is available.
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Reproduction and morphology of Central American and Tres Marias spinner dolphins in the eastern tropical Pacific
Marine Mammal Science (1.665)
S. J. Chivers, **W. L. Perryman**, and **M. S. Lynn (NMFS/SWFSC)**

- Vertical aerial photographs taken between 1988 and 2006 in the eastern tropical Pacific provided a refinement of the distribution of coastal spinner dolphin morphotypes off Mexico, including a range extension for Central American spinner dolphins, a coastal species off Mexico.
- This study provided the first life history parameter values for coastal spinner dolphins and a comparison of coastal to pelagic spinner dolphins.

Morphological characters and distribution provide strong evidence for distinct geographic forms of spinner dolphins (*Stenella longirostris*). In the eastern tropical Pacific, two large coastal forms: the Central American and Tres Marias, and two smaller pelagic ones: the eastern and whitebelly are recognized. Vertical aerial photographs of 57 spinner dolphin schools taken between 1988 and 2006 yielded measurements of individual dolphins to review the range of coastal forms and to characterize their calving seasons. Bayesian hierarchical models were used for analyses, which facilitated integration of fishery by-catch and vertical aerial photographic body length data. On the basis of body length, spinner dolphins photographed off Guerrero, Mexico were identified as the Central American morphotype, which is north of their known range, and those photographed farther north, approximately 112 km off Nayarit, Mexico were identified as Tres Marias

spinner dolphins. Calving peaked from October through March, and there was evidence that calving seasons differed among geographic forms with coastal forms calving later than pelagic forms. These are the first life history parameter values for the coastal spinner dolphin forms, and the first evidence of the Central American spinner dolphin occurring north of the Gulf of Tehuantepec, Mexico.
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Process convolution approaches for modeling interacting trajectories
Environmetrics (1.532)
H. R. Scharf, M. B. Hooten, D. S. Johnson, and **J. W. Durban (NMFS/SWFSC)**

- This paper describes a new statistical method for analyzing movement data from multiple animals tracked simultaneously.
- The key features of this new method include learning about underlying social structure in the population and reducing uncertainty about individual tracks by modelling dependence between individuals.
- We demonstrate an application of process convolution chains to the study of the movement of killer whales, in which the paths taken by multiple individuals are not independent, but reflect dynamic social interactions within the population.

Gaussian processes are a fundamental statistical tool used in a wide range of applications. In the spatio-temporal setting, the covariance of a Gaussian process is typically a function of relative locations in space and time, and must satisfy the condition of non-negative definiteness. Several families of covariance functions exist to accommodate the wide variety of dependence structures arising in different applications while ensuring non-negative definiteness. These parametric families can be restrictive, and are insufficient in some situations. In contrast, process convolutions represent a flexible, interpretable approach to defining the covariance of a Gaussian process, and have modest requirements to ensure validity. We introduce a generalization of the process convolution approach that employs multiple convolutions sequentially to form a "process convolution chain." In our proposed multi-stage framework, complex dependencies that arise from a combination of different interacting mechanisms are decomposed into a series of

interpretable kernel smoothers. The framework builds upon, and extends, the advantages of flexibility and interpretability inherent in process convolutions. We demonstrate an application of process convolution chains to the study of the movement of killer whales, in which the paths taken by multiple individuals are not independent, but reflect dynamic social interactions within the population. Our proposed model for dependent movement provides inference for the latent dynamic social structure in the study population. Additionally, by leveraging the positive dependence among individual paths, we achieve a reduction in uncertainty for the estimated locations of the whales, compared to a model that treats paths as independent.
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First satellite tracks of South Atlantic sea turtle 'lost years': Seasonal variation in trans-equatorial movement
Proceedings of the Royal Society B: Biological Sciences (4.823)
K. L. Mansfield, M. L. Mendilaharsu, N. F. Putman, M. A. G. dei Marcovaldi, A. E. Sacco, G. Lopez, T. Pires, and **Y. Swimmer (NMFS/PIFSC)**

- Laboratory-reared loggerhead turtles were satellite-tagged and released alongside drifters from Brazil to examine active and passive dispersal mechanisms.
- Turtles moved in opposite directions depending on the season, but surface currents alone did not dictate movement, suggesting turtles' swimming influenced positioning within fronts.
- This study has important implications for understanding possible nursery grounds and survivorship of hatchlings throughout the hatching season, especially as these divergent migratory routes may increase population resilience.

In the South Atlantic Ocean, few data exist regarding the dispersal of young oceanic sea turtles. We characterized the movements of laboratory-reared yearling loggerhead turtles from Brazilian rookeries using novel telemetry techniques, testing for differences in dispersal during different periods of the sea turtle hatching season that correspond to seasonal changes in ocean currents.

Oceanographic drifters deployed alongside satellite-tagged turtles allowed us to explore the mechanisms of dispersal (passive drift or active swimming). Early in the hatching season turtles transited south with strong southward currents. Late in the hatching season, when currents flowed in the opposite direction, turtles uniformly moved northwards across the Equator. However, the movement of individuals differed from what was predicted by surface currents alone. Swimming velocity inferred from track data and an ocean circulation model strongly suggest that turtles' swimming plays a role in maintaining their position within frontal zones seawards of the continental shelf. The long nesting season of adults and behaviour of posthatchlings exposes young turtles to seasonally varying ocean conditions that lead some individuals further into the South Atlantic and others into the Northern Hemisphere. Such migratory route diversity may ultimately buffer the population against environmental changes or anthropologic threats, fostering population resiliency.
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http://rspb.royalsocietypublishing.org/content/284/1868/20171730

NESDIS Publications

Electron fluxes at geostationary orbit from GOES MAGED data
Space Weather (2.846)
I. Sillanpää, N. Y. Ganushkina, S. Dubyagin, and **J. V. Rodriguez**
(NESDIS/NCEI)

- This study models electron fluxes at energy levels below 200 keV in geostationary orbit based on magnetic local time, solar wind speed, and magnetic field strength (IMF B_Z)
- Higher solar wind speed and negative IMF B_Z correlated with higher electron flux with some dependence on magnetic local time
- These findings have impacts on satellite operations and show the value of long term monitoring and data stewardship

Electron behavior in energies below 200 keV at geostationary orbit has significance for satellite operations due to charging effects on spacecraft. Five years of keV energy electron measurements by the geostationary GOES-13 satellite's MAGED instrument have been analyzed. A method for determining

flight-direction integrated fluxes is presented. The electron fluxes at the geostationary orbit are shown to have significant dependence on solar wind speed and IMF B_Z: increased solar wind speed correlates with higher electron fluxes with all magnetic local times while negative IMF B_Z increases electron fluxes in the 0 to 12 MLT sector. A predictive empirical model for electron fluxes in the geostationary orbit for energies 40, 75, and 150 keV was constructed and is presented here. The empirical model is dependent on three parameters: magnetic local time, solar wind speed, and IMF B_Z.
Publication date: December 7, 2017
Available online: http://onlinelibrary.wiley.com/doi/10.1002/2017SW001698/full

Quality control of oceanographic in situ data from Argo floats using climatological convex hulls
MethodX (3.802)
T. U. Bhaskar, R. V. Shesu, **T. P. Boyer (NESDIS/NCEI)**, and E. P. R. Rao

- The complex relationship of temperature and salinity in the global ocean is not well captured by the mean and standard deviation within a strict geographic grid.
- Quality control of oceanographic profile data is better served by a more mathematically advanced system of irregularly shaped ‘hulls’ to better capture outliers in the temperature and salinity fields.

A new method of identifying anomalous oceanic temperature and salinity (T/S) data from Argo profiling floats is proposed. The proposed method uses World Ocean Atlas 2013 climatological mean fields to classify good against anomalous data by using convex hulls. An n-sided polygon (convex hull) with least area encompassing all the climatological points is constructed using Jarvis March algorithm. Subsequently the Points In Polygon (PIP) principle implemented using ray casting algorithm is used to classify the T/S data as within or without acceptable bounds. It is observed that various types of anomalies associated with the oceanographic data viz., spikes, bias, sensor drift, etc. can be identified using this method. Though demonstrated for Argo data it can be applied to any oceanographic data. The patterns of variation of the parameter (temperature or salinity) corresponding to a particular depth, along the longitude or latitude, can be used to build convex hulls. This method can be effectively used for quality control

by building convex hulls for various observed depths corresponding to biogeochemical data which are sparsely observed. This method has the advantage of treating the bulk of oceanographic *in situ* data in a single iteration which filters out anomalous data.
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Contrasting early Holocene temperature variations between monsoonal East Asia and westerly dominated Central Asia

Quaternary Science Reviews (4.571)

J. Zhao, C-B. An, Y. Huang, **Carrie Morrill (NESDIS/NCEI)**, and F. Chen

- New temperature reconstructions show several abrupt and large (4-9°C) temperature changes over the past 10,000 years in Asia that occurred along with major changes in moisture availability.
- Climate models simulate changes in temperature that are more muted than the new reconstructions, raising questions about what caused past abrupt climate changes and whether state-of-the-art models are capable of simulating such changes for the past or for the future.
- Results identify a significant mismatch between observations and models and call for more research to resolve this.

Numerous studies have demonstrated that there are major differences in the timing of maximum Holocene precipitation between the monsoonal East Asia and westerly dominated Central Asia, but it is unclear if the moisture differences are also associated with corresponding temperature contrasts. Here we present the first alkenone-based paleotemperature reconstructions for the past 21 kyr from Lake Balikun, central Asia. We show, unlike the initiation of Holocene warm conditions at ~11 kyr BP in the monsoon regions, the arid central Asia remained in a glacial-like cold condition prior to 8 kyr BP and experienced abrupt warming of ~9 °C after the collapse

of the Laurentide ice sheet. Comparison with pollen and other geochemical data indicates the abrupt warming is closely associated with major increase in the moisture supply to the region. Together, our multiproxy data indicate ~2 thousand years delay of temperature and moisture optimum relative to local summer insolation maximum, suggesting major influence of the Laurentide ice sheet and other high latitude ice sheet forcings on the regional atmospheric circulation. In addition, our data reveal a temperature drop by ~4 °C around 4 kyr BP lasting multiple centuries, coinciding with severe increases in aridity previously reported based on multiproxy data. In contrast, model simulations display a much less pronounced delay in the initiation of Holocene warm conditions, raising unresolved questions about the relative importance of local radiative forcing and high-latitude ice on temperature in this region.

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https://www.sciencedirect.com/science/article/pii/S0277379117300458

Global assessment of benthic nepheloid layers and linkage with upper ocean dynamics
Earth and Planetary Science Letters (4.724)
W. D.Gardner, M. J. Richardson, and **A. V. Mishonov (NESDIS/CICS)**

- Benthic nepheloid layers are most intense beneath areas of high eddy kinetic energy.
- Deep western boundary currents are too weak to generate intense nepheloid layers.
- Benthic storms erode the seafloor and maintain the benthic nepheloid layer.
- High benthic kinetic energy and energy dissipation match strong nepheloid layers.

Global maps of the maximum bottom concentration, thickness, and integrated particle mass in benthic nepheloid layers are published here to support collaborations to understand deep ocean sediment dynamics, linkage with upper ocean dynamics, and assessing the potential for scavenging of adsorption-prone elements near the deep ocean seafloor. Mapping the intensity of benthic particle concentrations from natural oceanic processes also provides a baseline that will aid in quantifying the industrial impact of current and future deep-sea mining. Benthic nepheloid layers have been mapped using 6,392 full-depth profiles made during 64 cruises using our transmissometers mounted on CTDs in multiple national/international programs including WOCE, SAVE, JGOFS, CLIVAR-Repeat Hydrography, and GO-SHIP during the last four decades. Intense benthic nepheloid layers are found in areas where eddy kinetic energy in overlying waters, mean kinetic energy 50 m above bottom (mab), and energy dissipation in the bottom boundary layer are near the highest values in the ocean. Areas of intense benthic nepheloid layers include the Western North Atlantic, Argentine Basin in the South Atlantic, parts of the Southern Ocean and areas around South Africa. Benthic nepheloid layers are weak or absent in most of the Pacific, Indian, and Atlantic basins away from continental margins. High surface eddy kinetic energy is associated with the Kuroshio Current east of Japan. Data south of the Kuroshio show weak nepheloid layers, but no transmissometer data exist beneath the Kuroshio, a deficiency that should be remedied to increase understanding of eddy dynamics in un-sampled and under-sampled oceanic areas.

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